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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/510,265	10/05/2004	Hee Young Kim	644P002	1627
42754	7590	12/04/2006	EXAMINER	
NIELDS & LEMACK 176 EAST MAIN STREET, SUITE 7 WESTBORO, MA 01581			VANOY, TIMOTHY C	
			ART UNIT	PAPER NUMBER
			1754	

DATE MAILED: 12/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/510,265

Applicant(s)

KIM ET AL.

Examiner

Timothy C. Vanoy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 13 November 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

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## **DETAILED ACTION**

### ***Priority***

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Specification***

a) The abstract submitted with the amendment filed on Nov. 13, 2006 is objected to because there are informal hand-written marks on the 4<sup>th</sup> line of this abstract.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

The person having ordinary skill in the art has the capability of understanding the scientific and engineering principles applicable to the claimed invention. The references of record in this application reasonably reflect this level of skill.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-11 are again rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent 6,610,135 to Ohmori et al. in view of the article titled "Preparation of Monodisperse  $ZrO_2$  by the Microwave Heating of Zirconyl Chloride Solutions" by Young Tae Moon and the article titled "Preparation of Monodisperse and Spherical Zirconia Powders by Heating of Alcohol-Aqueous Solutions" by Young Tae Moon et al.

Col. 1 In. 58 to col. 2 In. 2 in U. S. Patent 6,610,135 B1 describes a method for making a titania sol by hydrolyzing titanium tetrachloride in an aqueous solution in the presence of a carboxylic acid so as to produce sol of titanium-containing fine particles having an average diameter of 0.8 to 50 nm. Col. 3 Ins. 17-25 reports that the concentration of titanium tetrachloride in the aqueous solution ranges from 0.1 to 6.5 moles/Liter, and col. 3 Ins. 48-53 reports that the hydrolysis of the titanium tetrachloride is conducted at a temperature ranging from 50 °C to the boiling point of the aqueous solution of the titanium tetrachloride. Col. 4 In. 63 to col. 5 In. 3 sets forth that a stabilizer can be incorporated into the aqueous liquid prepared by hydrolysis so as to

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prevent coagulation of the aqueous liquid or aqueous sol. Col. 5 ln. 66 to col. 6 ln. 5 sets forth that the process may be continuous with a single reaction vessel employed as a continuous reactor.

The difference between the applicants' claims and U. S. Patent 6,610,135 B1 is that the applicants' claims are specifically drawn to the production of a zirconia sol whereas the process of U. S. Patent 6,610,135 is drawn to the production of a titania sol, however it is submitted that this difference would have been obvious to one of ordinary skill in the art at the time the invention was made because titanium and zirconium belong to the same chemical group in the Periodic Table and elements within the same chemical group in the Periodic Table are known to have similar chemical and physical properties and are, therefore, submitted to be obvious variants of each other.

The difference between the applicants' claims and U. S. Patent 6,610,135 B1 is that the applicants' claims are drawn to the microwave heating of the zirconium salt solution, whereas the disclosure set forth in col. 3 lns. 50 et seq. in U. S. Patent 6,610,135 B1 does not expressly set forth the use of microwaves to heat the zirconium salt solution.

The abstract of the Moon et al. article "Preparation of Monodisperse  $\text{ZrO}_2$  by the Microwave Heating of Zirconyl Chloride Solutions" sets forth that microwaves are an excellent means of uniformly heating a zirconyl chloride-containing solution to provide zirconia particles in a rapid fashion so as to produce monodisperse and spherical zirconia particles.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the process described in U. S. Patent 6,610,135 B1 by heating the zirconium salt solution with microwaves, as required by the applicants' claims, because the abstract of the Moon et al. article "Preparation of Monodisperse  $ZrO_2$  by the Microwave Heating of Zirconyl Chloride Solutions" sets forth that microwaves are an "excellent" means for rapidly and uniformly heating a zirconium salt solution to obtain monodisperse and spherical zirconia particles.

The difference between the applicants' claims and the disclosure of U. S. Patent 6,610,135 B1 is that applicants' claim 4 calls for the use of a mixture of water and alcohol as the solution for zirconium salt (whereas the process of U. S. Patent 6,610,135 B1 does not appear to use an alcohol in their solvent).

The abstract of the Moon et al. article "Preparation of Monodisperse and Spherical Zirconia Powders by Heating of Alcohol-Aqueous Salt Solutions" sets forth a process for preparing zirconia powders from a solution of zirconyl chloride (please also see "II. Experimental Procedure") wherein when an alcohol was added to the water solvent the resulting particles had a narrow particle size distribution.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of U. S. Patent 6,610,135 B1 by preferentially including an alcohol with the water solvent for the zirconium salt, in the manner set forth in applicants' claim 4, because the abstract of the Moon et al. article "Preparation of Monodisperse and Spherical Zirconia Powders by Heating of Alcohol-Aqueous Salt

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Solutions" fairly suggests that the inclusion of the alcohol in the solvent will result in a narrow particle size distribution for the product zirconia.

### ***Response to Arguments***

Applicant's arguments filed on Nov. 13, 2006 have been fully considered but they are not persuasive.

a) *The applicants argue that their method is fundamentally different from Ohmori et al. reference which discloses a stirred reactor and from the Moon et al. references which discloses a non-stirred, static and non-flow state, whereas the applicants prepare high quality, spherical, non-agglomerated and monodisperse zirconia particles in a tubular reactor in a continuous flow state.*

U. S. Patent 6,610,135 B1 discloses this option of using a continuous reactor in col. 5 ln. 66 to col. 6 ln. 6. It is submitted that when this option of using a continuous reactor is used, then the resulting particles of U. S. Patent 6,610,135 B1 will also be high quality, spherical, non-agglomerated and monodisperse.

The abstract of the Moon et al. article "Preparation of Monodisperse  $\text{ZrO}_2$  by the Microwave Heating of Zirconyl Chloride Solutions" sets forth that microwaves are an excellent means of uniformly heating a zirconyl chloride-containing solution to provide zirconia particles in a rapid fashion so as to produce **monodisperse** and **spherical** zirconia particles.

b) *The applicants argue that Ohmori et al. relates to the preparation of a titania sol, not a zirconia sol.*

The difference between the applicants' claims and U. S. Patent 6,610,135 B1 is that the applicants' claims are specifically drawn to the production of a zirconia sol whereas the process of U. S. Patent 6,610,135 is drawn to the production of a titania sol, however it is submitted that this difference would have been obvious to one of ordinary skill in the art at the time the invention was made because titanium and zirconium belong to the same chemical group in the Periodic Table and elements within the same chemical group in the Periodic Table are known to have similar chemical and physical properties and are, therefore, submitted to be obvious variants of each other.

c) *The applicants argue that Ohmori et al. has a non-uniform irregular flow pattern whereas the applicants have a uniform flow pattern with a constantly maintained velocity gradient in the radial direction.*

When the option of using the continuous reactor set forth in col. 5 ln. 66 to col. 6 ln. 7 in U. S. Patent 6,610,135 is used, then it is expected that the flow pattern will inherently be the same.

d) *The applicants argue that the change in temperature pattern with time (of the prior art?) compared to the solution temperature increases with tube distance of the present invention.*

When the option of using the continuous reactor set forth in col. 5 ln. 66 to col. 6 ln. 7 in U. S. Patent 6,610,135 is used, then it is expected that the temperature patterns will be the same.



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e) *The applicants argue that in Ohmori et al. there is a hydrolysis reaction with no mention of precipitation, whereas the applicants' invention involves hydrolysis and precipitation (Figs. 1 and 2 and paragraphs [0049] to [0060]).*

The applicants' independent claim is silent with respect to precipitation. The Moon et al. article titled "Preparation of Monodisperse  $\text{ZrO}_2$  by the Microwave Heating of Zirconyl Chloride Solutions" discloses precipitation: please see the first page, II Experimental, the beginning of the second full paragraph.

f) *The applicants argue that Ohmori et al. generate HCl as a gaseous by-product whereas there is no generation of HCl vapor in the instant method.*

At least Example 1 in U. S. Patent 6,610,135 B1 is silent with respect to the generation of gaseous HCl.

g) *The applicants argue that according to the Moon et al. articles, synthesis of spherical zirconia powder is significantly influenced by such experimental conditions as stirring speed, temperature uniformity and heating rate (Ins. 21-30 of I. Introduction on pgs. 1103 of the first cited Moon et al. article), and the product quality of spherical zirconia powders differ greatly depending on the synthesis methods chosen even under the same chemistry (Ins. 1-34 of I. Introduction on pg. 2690 in the second cited Moon et al. article). This means that in view of the Moon et al. articles, one skilled in the art would not be motivated to apply the Ohmori et al. method to the preparation of hydrous zirconia particles. Indeed, even for a specific material to be prepared (like zirconia particles), the most optimum method and means should be selected and optimized among various methods application to preparation of the specific material.*

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The argument is not accompanied with any reasoning as to why the disclosures of the Moon et al. articles would teach away from the application of the Ohmori et al. method to the preparation of hydrous zirconia particles via a continuous method.

h) *The applicants argue that Ohmori et al. emphasizes that product should not be prepared in the form of dried powder because narrowly distributed spherical and non-coagulated particles cannot be obtained by drying of the aqueous sol obtained by the reaction (col. 4 Ins. 19-26 and Examples 1-5). This is completely contrary to the object and observations in the present invention and teaches away therefrom. The shapes of the instant hydrous zirconia particles can be confirmed by SEM in a dried state and the hydrous zirconia particles are dried at 85 °C for 24 hours and do not agglomerate. This discrepancy between Ohmori et al. and the present invention exemplifies the fundamental differences between Ohmori et al. and the present invention in terms of chemical backgrounds, reaction technology and means and hydrodynamic and thermal environments pursued.*

When the option of using a continuous process is chosen (as described in col. 5 ln. 66 to col. 6 ln. 7 in U. S. Patent 6,610,135 B1), then the resulting particles are expected to have the same properties - to include the argued lack of agglomeration.

i) *The applicants argue that with respect to the Moon et al. references, key technical elements of the present invention as claimed are different from the teachings of Moon et al. Indeed, the instant specification at paragraphs [0014] to [0016] argue that the teachings of Moon et al. are valid only at small volume flasks in a non-stirred static state. The present inventors discovered that non-agglomerated (non-coagulated)*

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*high-quality product with a spherical shape and narrow size distribution can be obtainable only by a precipitation method under a thermal environment provided in a flow state within a reaction tube even when microwave is selected as a heating medium.*

The Moon et al. references are not relied on for their teachings of using a small volume flask under a non-stirred static state. The argument is not accompanied with a showing of which limitation in the applicants' independent claim are considered to be unobvious from the applied references.

The abstract of the Moon et al. article "Preparation of Monodisperse  $\text{ZrO}_2$  by the Microwave Heating of Zirconyl Chloride Solutions" sets forth that microwaves are an excellent means of uniformly heating a zirconyl chloride-containing solution to provide zirconia particles in a rapid fashion so as to produce **monodisperse** and **spherical** zirconia particles. When the option of using a continuous process is chosen (as described in col. 5 ln. 66 to col. 6 ln. 7 in U. S. Patent 6,610,135 B1), then the resulting particles are expected to have the same properties - to include the argued lack of agglomeration.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the

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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy C. Vanoy whose telephone number is 571-272-8158. The examiner can normally be reached on Mon-Fri 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman, can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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*Timothy C Vandy*  
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Primary Examiner  
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